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ABSTRACT

Investigated were the effects of varying instructional explicitness (minimal, general, and explicit) and types of reinforcement (none, extrinsic, and intrinsic or relational) on the learning of an oddity discrimination task by 48 nursery school children. Ss were randomly assigned to six groups where general or minimal instructional explicitness was reinforced in one of three ways. Twelve other children were assigned to a contrast group that received particularly explicit instructions and intrinsic reinforcement. No significant differences in learning were found among the six groups of the major design, but the contrast group was found to perform significantly better when compared with groups receiving minimal and general instruction. No significant difference emerged from an analysis of the contrast condition with the three reinforcement conditions. Different stimuli were used in a test of transfer of training in which 32 of 34 Ss who had earlier reached criterion made successful transfers. A significant correlation of chronological age and original learning was found across the total subject sample, but not within any group or condition except the minimal instruction-no reinforcement condition. Data from two other samples involved in a replication study and an initial pilot study were also reported. (Author/GW)

RESEARCH REPORT #32

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EFFECTS OF VARIOUS INSTRUCTION AND REINFORCEMENT CONDITIONS ON THE LEARNING OF A THREE-POSITION ODDITY PROBLEM BY NURSERY SCHOOL CHILDREN

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(Place of publication shown in parentheses where applicable.)

1. D. Feldman. The Fixed-Sequence Hypothesis: Individual Differences in the Development of School Related Spatial Reasoning. Research Report #1, March, 1970.

2. D. Feldman & W. Markwalder. Systematic Scoring of Ranked Distractors for the Assessment of Piagetian Reasoning Levels. Research Report #2, March, 1970. (Educational and Psychological Measurement, 1971, 31, 347-362.)

3. D. Moores. Evaluation of Preschool Programs: An Interaction Analysis Model. Occasional Paper #1. April, 1970. (Keynote Address, Diagnostic Pedagogy, International Congress on Deafness. Stockholm, August 1970, also presented at American Instructors of the Deaf Annual Convention, St. Augustine, Florida, April, 1970).

4. J. Turnure. Reactions to Physical and Social Distractors by Moderately Retarded Institutionalized Children. Research Report #3. June, 1970. Journal of Special Education, 1970, 4, 283-294.

5. J. Turnure, J. Rynders, & N. Jones. Effectiveness of Manual Guidance, Modeling & Trial & Error Learning for Inducting Instrumental Behavior in Institutionalized Retardates. Research Report #4. June, 1970.

6. J. Turnure & M. Walsh. The Effects of Varied Levels of Verbal Mediation on the Learning & Reversal of Paired-Associates by Educable Mentally Retarded Children. Research Report #5. June, 1970. (Study I: American Journal of Mental Deficiency, 1971, 76, 60-67. Study II: American Journal of Mental Deficiency, 1971 in press).

7. R. Martin & L. Berndt. The Effects of Time-Out on Stuttering in a 12-year-old Boy, Research Report #6. July, 1970. (Exceptional Children, 1970, 37, 303-304).

8. J. Turnure, M. Thurlow, & S. Larsen. Syntactic Elaboration in the Learning & Reversal of Paired-Associates by Young Children. Research Report #7, January, 1971.

9. D Feldman & J. Bratton. On the Relativity of Giftedness: An Empirical Study. Research Report #8. Aug., 1970. (American Educational Research Annual Conference, N. Y., February, 1971.

10. R. Rubin & B. Balow. Prevalence of School Learning & Behavior Disorders in a Longitudinal Study Population. Research Report #9. October, 1970. (Exceptional Children, 1971, 38, 293-299).

11. R. Rubin. Sex Differences in Effects of Kindergarten Attendance on Development of School Readiness and Language Skills. Research Report #10. October, 1970. (Elementary School Journal - in press).

12. R. Bruininks & W. Lucker. Change and Stability in Correlations Between Intelligence and Reading Test Scores Among Disadvantaged Children. Research Report #11. October, 1970. (Journal of Reading Behavior, 1970, 2, 295-305)

13. R. Bruininks. Teaching Word Recognition to Disadvantaged Boys with Variations in Auditory and Visual Perceptual Abilities. Research Report #12. November, 1970. (Journal of Learning Disabilities, 1970, 3, 30-39)

14. R. Bruininks & C. Clark. Auditory and Visual Learning in First Grade Educable Mentally Retarded Normal Children. Research Report #13. November, 1970. (American Journal of Mental Deficiency, in press)

15. R. Bruininks & C. Clark. Auditory and Visual Learning in First-, Third-, and Fifth-Grade Children. Research Report #14. November 1970.

16. D. Moores. Education of the Deaf in the United States*, Occasional Paper #2. November, 1970. (Moscow Institute of Defectology, 1971, Pub'ished in Russian)

17. J. Rynders. Industrial Arts for Elementary Mentally Retarded Children: An Attempt to Redefine and Clarify Goals. Occasional Paper #3. January, 1971.

18. D. Feldman. Map Understanding as a Possible Crystallizer of Cognitive Structures. Occasional Paper #4. January, 1971. (American Educational Research Journal, 1971, 3, 484-502)

19. P. Broen & G. Siegel. Variations in Normal Speech Disfluencies. Research Report #15. January, 1971 (Language & Speech, in press)

20. D. Feldman, B. Marrinan, & S. Hartfeldt. Unusualness, Appropriateness, Transformation and Condensation as Criteria for Creativity". Research Report #16. February, 1971. (American Educational Research Association Annual Conference, New York, February 1971)

21. D. Moores. Neo-Oralism and the Education of the Deaf in the Soviet Union. Occasional Paper #5. February, 1971. (Exceptional Children, January, 1972, 38, 377-384).

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Center in Education of Handicapped Children
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RESEARCH AND DEVELOPMENT CENTER
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The University of Minnesota Research, Development and Demonstration Center in Education of Handicapped Children has been established to concentrate on intervention strategies and materials which develop and improve language and communication skills in young handicapped children.

The long term objective of the Center is to improve the language and communication abilities of handicapped children by means of identification of linguistically and potentially linguistically handicapped children, development and evaluation of intervention strategies with young handicapped children and dissemination of findings and products of benefit to young handicapped children.

Abstract

The effects of varying instructional explicitness (minimal, general, and explicit) and type of reinforcement (none, extrinsic, and intrinsic or relational) on young children's learning of an oddity discrimination task were investigated. Forty-eight nursery school children were randomly assigned to the six cells of a 2 (instructions, minimal or general) x 3 (reinforcement) factorial design, and 12 others to an outside contrast group that received particularly explicit instructions and intrinsic reinforcement, which was considered to be an especially favorable combination. No significant differences in learning were found among the six groups of the major design, but the outside contrast group was found to perform significantly better when compared with the minimal and general instruction condition groups. No significant difference emerged from an analysis of the outside contrast condition with the three reinforcement conditions, however.

A test of transfer-of-training was made by use of different stimuli, and 32 of 34 subjects who earlier reached criterion showed successful transfer. Other notable findings from the study included: A significant correlation of CA and original learning across the total subject sample, but not within any group or condition save the minimal instruction - no reinforcement condition; significantly longer response latencies for criterion compared to non-criterion subjects, which was uniformly observed across all groups; and that virtually all subjects questioned on their ability to make "same" and "not same" identifications of the task stimuli could do so whether they had reached criterion or not.

Data from two other samples involved in a replication study and an initial pilot study are also reported. Many correspondences, but also some discrepancies with the previous findings were obtained. The results were discussed in some detail to provide a guide to future research.

Effects of Various Instruction and Reinforcement Conditions on the Learning of a Three-Position Oddity Problem by Nursery School Children

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Several recent studies by Turnure (1970a, b; Turnure & Zigler, 1964) have explored the basis of the persistent reports of inattentiveness or distractibility of mentally retarded children in school or other learning situations. Turnure (1970a) has suggested that some instances of non-task orientations which are the behavioral index of inattentiveness are best considered as natural and spontaneous instances of looking for help rather than indications of a defect in the ability to attend. The task employed by Turnure in his investigations was an oddity discrimination learning problem, and he has noted that the fact that such a task was very difficult for the low MA individual, i.e., not an age appropriate task, may have been an extremely important factor in the young retarded child's performance both in learning and glancing (i.e., non-task orientations). In fact, oddity learning research has repeatedly reported the difficulty of this task for the young child (Gollin & Shirk, 1966; Hill, 1965; Lippsitt & Serunian, 1963; Saravo & Gollin, 1969). The parameters of oddity learning in children, both normal and retarded, have been extensively explored by these and other researchers (cf. also Ellis, Hawkins, Pryer & Jones, 1963; Gollin, Saravo & Salten, 1967; House, 1964; Lubker & Spiker, 1966; Saravo, Bagby & Haskins, 1970) over the past decade. In preparation for further study of the young retarded child's attention and learning behavior on such a task, the present writers felt that exploration of some additional parameters possibly affecting oddity task performance seemed warranted. That is, in order to understand more fully the retarded child's behavior during learning, a clearer understanding of the variables involved in the learning of the task seemed a prerequisite.

Although the eventual application of the information obtained in the present study was to be the investigation of learning in the retarded, young normal children were used as subjects. Butterfield (1968, p. 361) has emphasized that the "cognitive processes of the retardates may be elucidated by studying normal persons of low MA's as well as by studying the retarded directly and that by doing so one can avoid some of the "the difficulties which are introduced by the atypical life histories of many readily available retardate subject pools." Turnure's previous findings on distraction and the mentally retarded (Turnure, 1970a, b) seemed entirely consistent with the developmental rather than defect approach to mental retardation implicit in Butterfield's statements, and in view of this and the fact that the present study was considered as an adjunct to a main line of investigation into attention processes in the mentally retarded, use was made of a more easily obtainable normal subject population.

The conventional oddity learning problem has been defined as one in which two stimuli are identical and the third, rewarded stimulus, is odd with respect to a single non-spatial dimension on any given trial. Generally, in such a three position oddity problem all positions in an array carry the odd stimulus an equal number of times, although this has not been the case in all oddity research (cf. Ellis et al., 1963; Hill, 1965; Moon & Harlow, 1955). Using the conventional form of the oddity learning task, Gollin and Shirk (1966) have found that only 42 percent of the four-year-olds they studied were able to reach a learning criterion of six consecutive correct responses. This they noted was considerably better than a finding earlier reported by Lipsitt and Serunium (1963) of only 17 percent of the four-year-olds tested being able to learn an oddity task. It must be noted that Lipsitt and Serunian's percentage is based on only a very small sample of children ($n = 6$) in contrast to the larger group which Gollin and Shirk investigated ($n = 24$), and so sampling problems may partially contribute to the wide difference in the number of learners found.

Saravo and Gollin (1969) note that even the finding of over 50 percent of preschool children unable to solve the oddity problem is somewhat surprising in view of the fact that a problem requiring response to oddity (i.e., point to the one that is not the same) appears in the Stanford-Binet at 4 1/2 years and it is a normally acquired ability in four-year-old children. Saravo and Gollin suggest that at least part of the difficulty for these young children may lie in the fact that in the traditional oddity task, the stimulus which is odd, and thus the correct choice on one trial, would be an incorrect choice on a later trial. Thus the correct choice is determined by the relation within a set of stimuli, and as such is a more difficult task than a simple discrimination of "same-not same." Saravo and Gollin, and others, have demonstrated, in fact, that four-year-olds are able to learn oddity with reasonable efficiency under conditions of minimum task interference. That is, when the task is constructed so that these young children need not inhibit a previously learned response in order to make a subsequent correct response, performance is somewhat improved (Saravo & Gollin, 1969; 56 percent 4-year-olds reached criterion; Saravo, Bagby, & Haskins, 1970: 54 percent). Typically in these studies the task stimuli are arranged so as to eliminate the reversal of stimuli from correct on one trial to incorrect on a later trial, or to minimize response tendencies such as perseverations, position preference, etc.

A great deal of the research in oddity learning has been along these lines and thus primarily concerned with determining task dimensions that affect oddity learning, rather than with what cognitive resources the child brings to the task and how these may be improved or changed so as to affect their oddity learning. That is not to say that the research to date has not concerned itself with the child's strategies and approaches to learning the oddity task (cf. Croll, 1970; Hill, 1965; Saravo, Bagby & Haskins, 1970). Primarily, however, it is the stimulus characteristics of the task which are manipulated in order to produce more efficient performance by the young child who approaches the task with certain typical strategies which can inhibit learning on the learning task as traditionally constructed.

Some recent literature (Bower, 1970; Reitman, 1970, Taylor & Whitely, 1971) suggests that an extremely influential factor in learning is the instructions or instructional training provided to the subject. Instruction or training may have the effect of directing the child's attention to the relevant dimensions of the task and/or away from the irrelevant dimensions, or even may provide or suggest to the child appropriate or useful strategies to employ for successful solution. Staats, Brewer, and Gross (1970) have shown that when appropriate training methods are employed, general attentional and discrimination skills as well as important cognitive repertoires can be acquired quite rapidly and are extremely effective in the development of various language and reading skills in young children. Croll (1970) has suggested that it might be possible to facilitate the acquisition of oddity discrimination in young children by minimizing the occurrence of incorrect strategies and increasing the initial availability of the oddity strategy so that the subject is likely to test it. Croll further suggests that it is unlikely that this can be easily achieved within the constraints of traditional methods for training oddity discrimination. No attempts have been made to date to affect the strategies employed by young children on the oddity discrimination task by use of instructions or instructional training, and the power of such procedures to facilitate learning in these children has not been investigated. Since it has been repeatedly shown to be relatively difficult for pre-school children, the conventional oddity learning task would seem to be a suitable task in which to investigate the influence of instruction and instructional training on the child's attention to and/or strategies for learning a task.

In the present study, a major variable under investigation was the effects of varying instructions on oddity learning in pre-school children. Three levels of instruction ranging from minimal to very explicit were investigated: a) minimal instruction supplied only a basic task orientation and description of the response required by the child; b) general instruction included, in addition to the above, a statement that the correct choice each time was the item that was "not the same as the others;" c) explicit instruction included a of the above as well as a more detailed description of how the correct choice was to be determined. It was hypothesized that increasing the detail and explicitness of the instructions should facilitate performance, possibly by focusing the child's attention to the relevant dimensions of the task, or possibly by making available the appropriate strategy for solution. An alternative hypothesis is clearly possible, however. It might be the case that by increasing the volume and detail of instruction the child may become increasingly confused and perform less well or at least no differently than if left on his own to solve the task. This alternative hypothesis seemed especially necessary to consider in view of the fact that a second major variable, the nature of reinforcement given for correct response was also investigated, and presented the possibility of negative as well as positive interactive effects between instruction and reinforcement conditions.

Reinforcement for correct response in most of the oddity learning research has consisted of a tangible reward such as a marble, a piece of candy (cf. Lubker & Spiker, 1966; Saravo & Gollin, 1969) or some sort of social reinforcement usually in the form of the subject being verbally informed by the experimenter that his response was correct or incorrect (cf. Lipsitt & Serunian, 1963; Gollin & Shirk, 1966).

Several recent studies (Turnure, 1970a, b) in which the oddity learning task was used, have employed a non-social reinforcement procedure in which subjects were informed that a response was correct by the onset of a light, a procedure similar to that used in a variety of investigations employing other discrimination learning tasks (Dorwart, Ezerman, Lewis & Rosenhan, 1965; Lewis, Wall, & Aronfreed, 1963; Terrell & Kennedy, 1957; Witryol, Lowden & Fagan, 1967). There has been widespread investigation into the differential effects of the various classes of reinforcement on discrimination learning, especially with regard to the differential effects of social and non-social reinforcement (Dorwart, <u>et al</u>., 1965; Lewis, <u>et al</u>., 1963; Terrell & Kennedy, 1957; Zigler & Kanzer, 1962), but little investigation of the reinforcement parameters has occurred in the area of oddity learning. In the present study, one dimension possibly involved in differential effects of various reinforcements is explored. It is posited that reinforcement which is "intrinsically meaningful" in some sense may be a more effective reinforcer for oddity learning in young children. That is, if in the oddity problem, the reinforcement stimulus which indicates the correct response is also related directly to the choice of the odd item, rather than being only an external symbol of a correct choice, such as the onset of a light or the dropping of a marble down a chute would be, then learning should be facilitated. Thus, two reinforcement conditions, both of which employed non-social reinforcement, but one of which was considered "intrinsically meaningful," and a third no reinforcement, control, condition constituted the second major variable of the present study.

The reinforcement believed to be more "intrinsically meaningful" consisted of presentation, upon correct response, of a picture identical to the odd item, resulting in the display of two matching pairs of stimuli on the apparatus for a short period prior to the presentation of the next trial. The more typical reinforcement involving presentation of a bright light following a correct response constituted the second reinforcement condition tested. A no reinforcement condition was included in order to control for possible oddity response preferences in children (Dickerson & Giradeau, 1970) which might result in a high baseline level of oddity response.

The present study then was a 2 x 3 two-factor design, instructions (minimal, general) x reinforcement (none, red light, same picture) which involved six experimental groups. A seventh group, the explicit instructions group, was also tested. As described earlier, the explicit instructions group received additional instructions in selection of the correct response; this group also received the most hypothetically facilitating reinforcement (same picture), according to the intrinsic meaningfulness hypothesis, and additional instruction as to the meaning of the picture reinforcement. In sum, then, it was expected that the performance of this group should exceed that of all other experimental groups and could provide an external comparison group with which to explore the relative effects of instruction, reinforcement and any interactions which might emerge.

Method

Subjects

Initial pilot work was undertaken to develop and test procedures with 37 nursery school children between the ages of 3-5 and 5-1. These children attended the University of Minnesota nursery school and the predominant number were test-experienced, having participated in numerous experimental investigations, but some of them were part of a new program for "disadvantaged" children who were known to perform quite divergently from the usual school population, so this data was considered too heterogeneous and experimentally suspect to be included as part of the study proper. (See Report 32 Appendix for description and comments regarding this pilot data.) Sixty nursery school children between the ages of 3-8 and 5-4 were selected as subjects for the study proper from two nursery schools located in St. Paul, Minnesota.[1] Children at both schools were characterized by the directors of the schools as coming from middle class families or higher, and being of above average IQ ability on the whole. Eight children were assigned to each of the six main experimental groups and 12 children were assigned to the seventh experimental group which received the explicit training. Mean chronological ages and standard deviations for each group, by school and with schools combined, are shown in Table 1.

Children from the first school (S1) were tested first and then additional children from the second school (S2) were selected and tested so as to expand the group sizes. Thus, assignment of children to experimental groups differed slightly for the two schools. Assignment of subjects from the first nursery school to experimental groups was accomplished by first listing all children available in the school and then randomly placing each of the seven youngest in one of the experimental groups, then the next seven youngest and so on until approximately an equal number of children were assigned to each experimental group. One additional child in the first school was assigned to the explicit instruction group. Subjects from the

Table 1

Mean Chronological Age (in months)and Standard Deviations for each

Experimental Group by Schools and Combined across Schools

Reinforcement Condition

	No Reinforcement			Red			Picture			Total	Explicit		
	S_1	S_2	Comb.	S_1	S_2	Comb.	S_1	S_2	Comb.	Schools Comb.	S_1	S_2	Comb.
Minimal Instruction													
$\overline{X}$	56.7	54.6	55.4	57.3	54.6	55.6	55.3	54.8	55.0	55.3	57.8	54.0	55.3
SD	2.1	4.2	3.5	5.0	4.4	4.5	4.5	5.3	4.7	4.1	6.7	7.2	7.0
n	3	5	8	3	5	8	3	5	8	24	4	8	12
General Instruction													
$\overline{X}$	59.3	54.8	56.5	56.0	55.0	55.4	59.7	55.2	56.9	55.7			
SD	4.2	5.1	5.0	5.3	4.9	4.7	3.8	3.9	4.3	7.0			
n	3	5	8	3	5	8	3	5	8	24			
Total	Schools Combined			Schools Combined			Schools Combined						
$\overline{X}$	55.9			55.5			55.9						
SD	4.2			4.4			4.4						
n	16			16			16						

second school were selected so as 1) to have a mean chronological age similar to that of the first nursery school subjects in each group, and 2) to include a range of ages from the youngest to the oldest children attending the school in each experimental group. Thus, the subjects chosen from the second nursery school were of specified ages, but the particular child at each age assigned to any one group was random. In addition extra children were again assigned to the explicit instruction condition in order to increase the n for that group and to permit comparison of that group with the others in a number of statistical analyses.

Although the overall mean age of the first nursery school subjects was slightly higher than of the second school ($\bar{X}$ S1 = 57.5 mos., $\bar{X}$ S2 = 54.7 mos.), a 2 (schools) x 2 (instruction condition) x 3 (reinforcement condition) analysis of variance of age produced no significant findings for any of these factors or their interactions. A t test between schools within the explicit condition alone was also nonsignificant (t = .80, df = 10). Finally, when each of the three reinforcement conditions was collapsed across school and instruction conditions, or when each of the instruction conditions was collapsed across school and reinforcement condition and compared by means of individual t tests with the explicit instruction condition, no significant age differences were found. Thus, it appears safe to conclude that the experimental groups were clearly balanced for age.

Apparatus

The main apparatus for presentation of the three-choice oddity problem consisted of a six-window stimulus presentation box placed on a table, as shown in Figure 1, before which the child was seated so as to be at eye level with the two rows of three four-inch square windows on one end. The windows in each row were one inch apart and the two rows were also one inch apart. The bottom row of windows were the response windows and gave-way approximately 1/8 to 1/4 inch when pressed; the top row of windows, the reinforcement windows, did not move. The stimuli were back-projected onto the clear plexiglass windows from a Kodak carousel projector located within the box. Each slide projected a stimulus figure in each of the three bottom windows as well as the reinforcement stimulus in the appropriate top window. A black shutter covered each of the top windows and no stimuli were visible in these windows until the first response made by the child.

Onset and offset of each slide as well as the window location and duration of all pushes made by the subject on the lower response windows were automatically recorded on an Esterline-Angus event recorder. Slides were coded so as to permit activation of photocells when they were projected. The photcell mechanism initiated the recording of the onset and offset of the stimuli as well as the recording of the subject's responses, and also initiated the recording of the operation of the shutters which covered the reinforcement windows. On any one trial (one slide) only one shutter would rise after a child's response and it would be the one covering the reinforcement window just above the first response window pushed. It remained up until a new slide was presented at which time the shutter would drop and the new stimuli would appear in the bottom response windows. In the no reinforcement conditions, however, the equipment

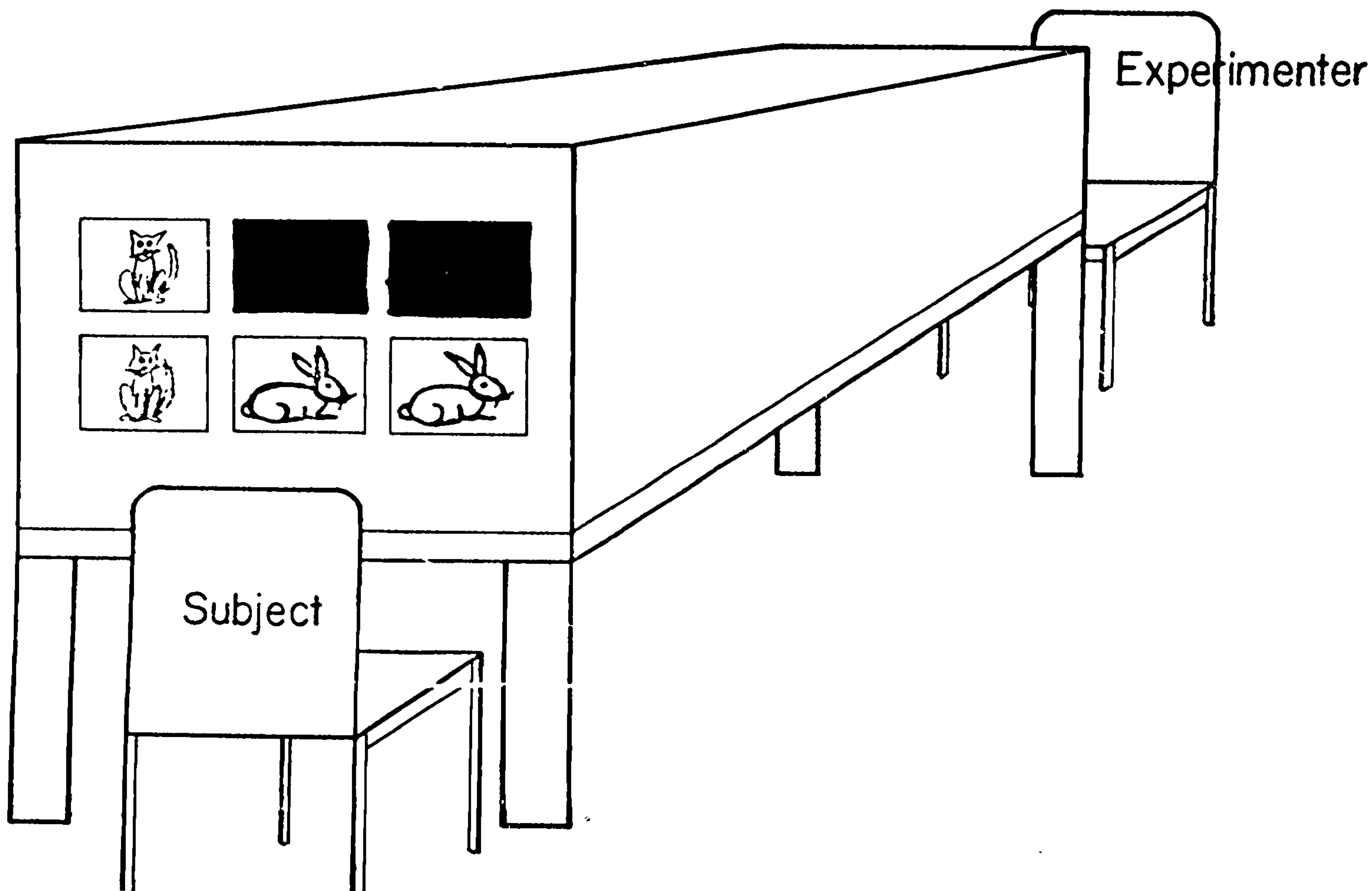

Figure 1

Stimulus Presentation Apparatus

was set so that no top shutter ever rose.

A timer mechanism controlled the cycle of slide presentation. A slide was presented and remained on for 7.5 seconds before automatically being changed to the next slide if no response was made by the subject during that period. If a response was made within the 7.5 seconds the slide remained on for only three seconds more and then was changed to the next slide. Immediately upon the first response, the shutter in the reinforcement window just above the response window pushed, rose and remained up until the slide changed at the end of the three seconds. Thus, the set of stimuli in the response windows could be on for as short a period as just over three seconds if the subject responded immediately when a new set of stimuli appeared, or for as long as 10.5 seconds if the subject waited until the last instant of the 7.5 second period to respond, in which case the slide would remain on for the additional 3 second period before changing to the next one. In all cases, the reinforcement stimulus was visible for the 3 second period only. The timer mechanism could be turned off so as to permit the experimenter to manually forward the slides by pressing a button.

All apparatus necessary to operate the projector, timers, recorder, etc., as well as the recorder itself were on the floor under the far end of the table from the subject and out of his direct view.

The stimulus figures presented for the initial task were black and white line drawings of three animals, a duck, a cat, and a rabbit. Two of these animals were paired on any one slide so as to present two similar and one different stimuli in the three lower response windows. Each animal figure was the odd stimulus an equal number of times, was presented an equal number of times in each window position, and was paired an equal number of times with each of the other two animal figures. The order of presentation of the 18 slides, which included all possible pairings of the three figures, was randomly determined and the same for all experimental groups. This ordering was presented twice to each subject for a total of 36 trials. Each slide projected a bright red patch of color (in red light reinforcement condition) or the identical odd picture (in the same picture reinforcement condition) directly over the correct odd choice. In the windows over the incorrect choices, a solid black space was projected. A separate set of slides was therefore necessary for each reinforcement condition.

In addition, a transfer set of 18 slides was available for each of the three reinforcement conditions. This set consisted of one slide of each of the 18 possible pairings of three geometric forms, o, Δ, ≻-≺.

Procedure

Subjects were invited to play an "animal picture game" and were taken individually from their classroom to an experimental room in the same building for one 15-minute session.

Subjects were seated in front of the apparatus and the experimenter sat to their right. The project was on when the child entered the room and the bottom three response windows were brightly illuminated, but showed no pictures; the top reinforcement windows were black since all shutters were down. The experimenter recorded the child's name, age, and classroom, and then rose and went to the back of the apparatus explaining to the child that he had to put on "just the right pictures for the game" he was about to play. Since the subjects were taken from their classrooms at times when they were unoccupied and willing to come, the experimenter could not put on the appropriate stimulus slide tray for the condition in which the child was being tested prior to their arriving in the experimental room. After placing the slide tray, the experimenter returned to the child's side and proceeded to instruct the child according to the particular experimental condition. All subjects received at least minimal instructions as to the object of the game and the way to push the windows. The degree to which further instructions were given constituted one of the two independent variables under investigation. Thus in the "minimal instruction" conditions, no instruction beyond this minimal instruction was given for the no reinforcement group, and for the two reinforcement groups a few sentences on the meaning of the red or picture reinforcement were added to these minimal instructions. In the "general instruction" conditions, however, subjects were additionally instructed that the right picture was the one that was "not the same as the others."

In the course of instructions for every group, demonstration of the pushing of the response windows was given. No pictures were viewed in the windows during the instructions and demonstration; only the light from the projector, present when the child entered, illuminated the response windows. In the two reinforcement conditions, when the shutter rose during each demonstration trial as it would in the actual trials, the reinforcement window was illunimated only by the light produced by the project being on.

The specific instructions given to each experimental group are described below:

No reinforcement - minimal instructions

In these windows you will see some animal pictures (experimenter points). You want to try and push the right picture everytime. Look at all the pictures to find the one that is right. Sometimes you will think that this is the right picture (experimenter points to middle window), so you will push here (experimenter presses). If you think that this is the right picture (experimenter points right) then push here (experimenter presses). Or, if you think this is the picture that is right, (experimenter points left) then push this one. Go ahead you do it this time (child presses). Remember, everytime the pictures come on you look at all of them and push the one you think is the right one.

No reinforcement - general instructions

In these windows you will see some animal pictures (experimenter points). You want to try and push the right picture everytime. The right picture is the one that is not the same as the others. Look at all of the windows to find the picture that is not the same as the others each time. Sometimes you will think that a picture here is the one that is not the same (experimenter points to middle), so you will push here (experimenter presses). If you think that the picture that is not the same is here (experimenter points right) then push here (experimenter presses). Or, if you think that the picture that is not the same is here (experimenter points left) then push this one on. Go ahead-you do it this time (child presses). Remember, everytime the pictures come on you look at all of them and push the one that you think is not the same as the others.

Red reinforcement - minimal instructions

In these windows you will see some animal pictures (experimenter points). You want to try and push the right picture everytime. Look at all the pictures to find the one that is right. After you push the right picture down here (experimenter points), a red light will go on above it, up here (experimenter points). The red light up here will tell you that you were right. Sometimes you will think that this is the right picture (experimenter points to middle) so you will push here (experimenter presses). If you think that this is the right picture (experimenter points right) then push here (experimenter presses). Or, if you think this is the picture that is right, (experimenter points left) then push this one. Go ahead, you do it this time (child presses). Remember, everytime the pictures come on you look at all of them and push the one you think is right. Then look at the top windows to see if you have pushed the right one.

Red reinforcement - general instructions

In these windows you will see some animal pictures (experimenter points). You want to try and push the right picture everytime. The right picture is the one that is not the same as the others. Look at all of the windows down here (experimental points) to find the picture that is not the same as the others, each time. After you push the picture that is not the same as the others down here (experimenter points), a red light will go on above it, up here (experimenter points). The red light will tell you that you were right. Sometimes you will think that a picture here is the one that is not the same (experimenter points to middle) so you will push here (experimenter presses). If you think that the picture that is not the same is here (experimenter points right) then push here (experimenter presses). Or, if you think that the picture that is not the same is here (experimenter points left) then push this one. Go ahead, you do it this time (child presses). Remember, everytime the pictures come on you look at all of them and push the one that you think is not the same as the others. Then look at the top windows to see if you have pushed the right one.

Picture reinforcement - minimal instructions

These instructions were identical to the red reinforcement - minimal instruction condition instructions with the following change in wording. "After you push the right picture down here (experimenter points) a picture _just like it_ will go on above it, up here (experimenter points). That picture will tell you that you were right." This similar change in wording was also made for the _picture reinforcement-general instruction_ condition which was otherwise identical to the red reinforcement-general instruction condition described above.

Explicit instructions

In these windows you will see some animal pictures (experimenter points). You want to try and push the right picture everytime. You will see two pictures that are the same and one that is not the same as the others. The right picture is the one that is not the same as the others. (You want to push the picture that is not the same as the others.) You want to push the picture that is not the same as the others everytime. Look at _all_ the windows to find the picture that is not the same each time. When you push the picture that is not the same you will see another picture just like it appear in the window above, up here (experimenter points). That picture on top will tell you you are right. So look at the windows on top to see if you have pushed the right picture, the one that is not the same as the others. If you don't see a picture like the one you pushed in the window on top, you will know that you have not pushed the right picture down here (experimenter points). Sometimes you will think that a picture here is the one that is not the same as the others, (experimenter points to middle) so you will push here (experimenter presses). If you think that the picture that is not the same is here (experimenter points right) then push here (experimenter presses). Or, if you think that the picture that is not the same as the others is here (experimenter points left) then push this one. Go ahead, you do it this time (child presses). Remember, everytime the pictures come on look at all of them and push the one that you think is not the same as the others, and try to make the picture just like it show in the window on top.

Following the specific instructions for each group, the experimenter indicated that he would now have to go to the back of the apparatus in order to show the pictures each time, and that the child was to begin playing the game by himself as soon as the pictures came on. The experimenter then went to the back of the apparatus where he sat down out of child's sight and switched the apparatus to automatic advance. Each child was told to begin as the first set of stimuli appeared. If the child was hesitant in the first few slides, the experimenter encouraged the child to go ahead and to push the picture he thought was the right one everytime.

During the 36 trials which followed, the experimenter observed data as it was recorded on the Esterline Angus recorder and noted if the child at any time achieved a criterion run, designated as seven or more consecutive responses (Grant, 1947). Following completion of the 36th trial the experimenter returned to the side of the child praising him for his performance.* Children who had reached criterion were given an additional 18 transfer trials. The instructions for these additional trials were as follows:

"I am going to show you a few more pictures now. The pictures will be a different kind, but I want you to play the game in exactly the same way as you just did."

The experimenter then replaced the original slide tray with that for the transfer slides. The same method of reinforcement (red, picture, none) as had been used in the original task was used in transfer.

*If in the last few trials the experimenter felt that the child was demonstrating learning and there were not enough trials remaining in the 36 to obtain evidence of a criterion run of seven, the experimenter repeated the last 10 slides. Those subjects who then did reach criterion were not considered criterion subjects for major analyses, but are specially designated in descriptive statistics.

Following transfer in the case of the criterion subjects, or after the original 36 trials for non-criterion subjects, the experimenter returned to the subject and asked him several questions in order to determine the child's understanding of the proper solution of the task and of the instructions which he had received. Preliminary questions included whether the child liked the game and whether he had pushed the correct picture everytime. The subject was then asked how he knew which picture to push each time. Subjects who received instructions that the correct picture was the one that was not the same as the others were asked if they remembered being told this, and further, whether they had pushed the one that was not the same as the others each time. Subjects in the reinforcement conditions were asked what the red light (or picture) in the top window told them when they saw it. This was generally followed by the question, did the red light (or picture) on top mean they were right or wrong?

All subjects in the general and explicit instruction conditions who did not reach criterion were further questioned in order to ascertain whether or not they understood their instructions, specifically, whether they understood the meaning of the phrase "not the same as the others." The experimenter backed up the slide tray and with the advance now under manual control questioned the subject in the following manner, referring with each question to a different slide. For three to four slides the experimenter told the child, "point to the one that is not the same as the others." This same procedure was followed for several additional slides with the experimenter now asking the subject to "point to the one that is different from the others" and then to "the ones that are the same." If the subject's response to the above questioning indicated that the child did not know the correct answer or was very unsure the experimenter pointed to one of the two identical figures and asked, "which is not the same as this one?" then, "which is different from this one?" and then "which is the same as this one?"

At the end of this questioning, which generally took no more than 3 to 5 minutes, the child was praised for his performance and returned to his classroom.

Results

Learning scores were the total number correct responses on the 36 trials. Table 2 shows the mean number correct for each experimental group, by school and combined across schools. Observation of this table suggests that within the no reinforcement condition, minimal versus general instructions resulted in large differential group performances, and further that this difference is attributable to the large difference in the performance in the two instruction conditions of the children from the second nursery school. However, a 2 (schools) x 2 (instruction condition) x 3 (reinforcement condition) analysis of variance of number correct scores produced no significant findings. Thus the apparent differences in mean number correct in this condition were not large enough to produce statistically significant differences in the overall analysis of variance. Other trends can be seen in the group

Table 2

Mean Number Correct, Standard Deviations and Number of Criterion Subjects for each Experimental Group, by School and Combined Across Schools

Reinforcement Condition

	No Reinforcement			Red			Picture			Total	Explicit		
	S_1	S_2	Comb.	S_1	S_2	Comb.	S_1	S_2	Comb.		S_1	S_2	Comb.
Minimal Instruction													
$\overline{X}$	17.3	9.6	12.5	22.0	17.0	18.9	26.7	16.8	20.5	16.9	25.9	29.4	28.2
SD	11.0	7.2	8.9	8.2	14.9	12.4	8.5	11.5	11.1	11.2	13.9	7.3	9.5
n	3	5	8	3	5	8	3	5	8	24	4	8	12
#Crit.Ss	1	0	1	1	2*	3	2	2	4	8	3	7	10
			(12.5%)			(37.5%)			(50%)	(33%)			(83%)
General Instruction													
$\overline{X}$	20.7	30.6	26.9	26.0	18.2	21.1	21.3	19.8	20.4	22.8			
SD	12.2	9.9	11.2	10.4	14.3	12.8	13.7	11.8	11.6	11.7			
n	3	5	8	3	5	8	3	5	8	24			
#Crit.Ss	2	4	6	2	2	4	2	2	4	14			
			(75%)			(50%)			(50%)	(58%)			
Total													
$\overline{X}$	19.0	20.1	19.7	24.0	18.5	20.6	24.0	18.3	20.4				
SD	10.6	13.8	12.3	8.9	13.1	11.6	10.6	11.1	10.9				
n	6	10	16	6	10	16	6	10	16				
#Crit.Ss	3	4	7	3	4	9	4	4	8				
			(44%)			(56%)			(50%)				

* Two subjects reached criterion after 36 trials, see footnote p. 21

means in Table 2, although any differences are merely suggestive and in no case did statistically significant differences emerge. When subject scores were combined across schools, and across reinforcement conditions, somewhat better performance was seen under general instruction conditions than under minimal instruction conditions. The difference between instruction conditions was clearly a larger one than among the means for the three reinforcement conditions, which, when scores were collapsed across schools and instruction conditions, were very similar, although a slight trend in the predicted direction is apparent.

In addition to the apparent differences within the no reinforcement condition, and some suggestion of facilitation of performance with general over minimal instructions, it appears that the mean number correct in the explicit instruction condition is noticeably greater in comparison to either of the other instruction conditions (collapsed across reinforcement condition), or to any of the three reinforcement conditions (collapsed across instructions). A $\underline{t}$ test between schools was performed for the explicit instruction condition and was found nonsignificant ($\underline{t} = -.52$, $\underline{df} = 10$). Since the explicit instruction group was external to the 2 x 2 x 3 design and could not be included in the original analyses of variance, two one-way analyses of variance were performed including this additional group. In both analyses schools were collapsed based on the failure to find earlier any statistical differences between schools. The first of these analyses, comparing the three reinforcement conditions (collapsed across instructions) with the explicit instruction condition was nonsignificant ($\underline{F} = 1.61$, $\underline{df} = 3, 56$). The second one-way analysis comparing minimal and general instruction conditions (collapsed across reinforcement conditions) with the explicit instruction condition, was, however, found significant ($\underline{F}$ = 3.81, $\underline{df}$ = 2, 57, $\underline{p}$ < .05). Further analysis by means of a Newman-Keuls procedure indicated that the explicit instruction condition was significantly different from the minimal instruction condition (p < .05), but not from the general instruction condition, and that there was no significant difference between the minimal and general instructions, a finding similar to that of the 2 x 2 x 3 overall analysis. These results suggest, then, that any facilitating effect on learning that the explicit instructions may have is primarily a function of the more detailed descriptions of how to select the correct item, rather than a function of the attempt to clarify and enhance the role of the reinforcing picture, which was done, in this study, primarily by greater specification and repetition of how and when it would appear.

Thirty-two of the 34 subjects reaching criterion transferred to the 18 trial geometric forms (obtained at least 75% correct <u>and</u> a criterion run = 7 correct) presented at the end of the 36 trials. One of these subjects refused to continue beyond the original 36 trials to perform the transfer task. Of the 33 remaining criterion subjects only one subject did not continue to choose the odd stimulus consistently during transfer. This subject had reached criterion at the very end of the original 36 trials and had made less than 10 consecutive correct responses on the original learning task before being given the transfer task.

Table 2 also presents the number and percentage of subjects in each experimental group reaching criterion, i.e., seven consecutive correct responses. These data were analysed by means of several chi-square analyses. As in the overall analyses of variance of the number correct, a 2 x 3 chi-square analysis of the number of criterion and non-criterion subjects across the three reinforcement conditions was nonsignificant ($\chi^2 = .48$, $\underline{df} = 2$). Similarly a 2 x 4 chi-square of the numbers of criterion and non-criterion subjects in the three reinforcement conditions and the explicit instruction condition was found nonsignificant ($\chi^2 = 5.43$, $\underline{df} = 3$). A 2 x 2 chi-square comparison of criterion and non-criterion subjects in the minimal and general instruction conditions was also nonsignificant ($\chi^2 = 1.33$, $\underline{df} = 1$). The one analysis which did reach significance was the 2 x 3 chi-square including minimal, general and explicit instruction conditions ($\chi^2 = 8.44$, $\underline{df} = 2$, $\underline{p} < .025$). The failure to find significant differences among most groups in the frequency of criterion and non-criterion subjects is consistent with the results of the analyses of variance of the number correct. The only chi-square analysis which was found significant, that comparing the explicit,general and minimal instruction subjects, parallels the only significant difference emerging from the analyses of variance.

It may be noted at this point that 51 percent of all the subjects tested in this study did reach criterion. Within specific experimental conditions the percentages range from 12.5 percent (no reinforcement-minimal instruction) to 83 percent (explicit instruction). Interestingly, for the minimal instruction condition, which might be considered the most similar to the procedures used by Gollin and Shirk (1966), the percentage of subjects attaining criterion is less than theirs, 33 percent. It might be more accurate, however, to exclude the no reinforcement condition in this comparison, since all children in Gollin and Shirk's study received reinforcement. When this is done 44 percent (7/16) of the children in the two comparable groups of the present study attained criterion, almost exactly the percentage found by Gollin and Shirk

A correlation of number correct scores with age for the total subject sample, schools and experimental conditions collapsed, was found significant at the .02 level (r = .31, df = 58); however, similar correlations for schools (S1 r = .41, df = 20; S2 r = .19, df = 36), for reinforcement conditions (no reinforcement r = 41, df = 14; red reinforcement r = .31, df = 14; picture reinforcement r = .10, df = 14), for instruction conditions (minimal instructions r = -.22, df = 22; general instructions r = .28, df = 22) and for the explicit condition alone (r = .22, df = 10) were all found nonsignificant. In fact in only one individual group, no reinforcement-minimal instructions, when schools were combined, was the correlation between age and number correct significant (r = .71, df = 6, $p < .05$), and this correlation must be interpreted with caution in view of the very small sample size involved (see Table 3).

The relationship between response latencies and learning scores has been explored in several previous studies in which an oddity learning task has been used (Turnure, 1972; Turnure & Larsen, 1971, 1972). Initial independent analyses of response latencies have shown that while differences in overall group mean latencies were not found, differences did emerge between mean pre- and post-criterion latencies for criterion subjects, and further between mean pre-criterion latencies for criterion and non-criterion subjects. Thus in the present investigation analyses similar to those described in these earlier studies were undertaken.

Initially a 2 (instruction condition) x 3 (reinforcement condition)

Table 3

Correlations between Number Correct Scores and Age for all Experimental Groups Combined across Schools

No reinforcement			
Minimal instruction	r = .71	n = 8	p < .05
General instruction	r = .25	n = 8	n.s.
Total	r = .41	n = 16	n.s.
Red reinforcement			
Minimial instruction	r = .44	n = 8	n.s.
General instruction	r = .21	n = 8	n.s.
Total	r = .31	n = 16	n.s.
Picture reinforcement			
Minimal instruction	r =-.22	n = 8	n.s.
General instruction	r = .44	n = 8	n.s.
Total	r = .10	n = 16	n.s.
Explicit	r = .22	n = 12	n.s.
Overall	r = .31	n = 60	p < .02

analysis of variance of the groups' overall mean latencies for the 36 trials of the learning task was performed and showed no significant differences. As in analyses of the number correct data in the present study, the explicit condition was compared with the three reinforcement conditions collapsed across schools and instruction conditions, and then with instruction conditions collapsed across schools and reinforcement conditions, in two independent one-way analyses of variance. *F*'s did not reach significance levels in either case. To investigate the finding reported in previous studies of differential pre- and post-criterion response latencies, a *t* test for correlated means was performed for those criterion subjects on whom both pre- and post-criterion response latencies were available. The difference reported in previous studies was again found in the present study ($\bar{X}$ pre = 3.3, $\bar{X}$ post = 2.7; $t = 3.52$, $df = 31$, $p < .01$). Therefore, further analyses of pre-criterion latencies were performed, and, in some instances, compared with similar analyses using overall mean latencies.

An analysis of variance of pre-criterion latency scores for all subjects in the 2 x 3 design, with non-criterion subjects' overall scores entered as reflecting their "pre-criterion" performance generated no significant findings. Neither of two independent one-way analyses comparing the explicit condition subjects with either the three reinforcement or two instruction conditions produced significant results. Thus, analyses of mean pre-criterion response latency scores between groups were as fruitless, in this case, as analyses of mean overall response latency scores, despite the correction for the differential pre and post-criterion performance of learners in this study.

Table 4 presents mean precriterion latencies for criterion and non-criterion subjects in all experimental groups. It can be seen from this table that in every experimental group the mean response latency for criterion subjects is longer than that for non-criterion subjects. A *t* test between mean response latencies for criterion and non-criterion subjects, collapsing across all conditions was found significant ($\bar{X}$ criterion = 2.7; $\bar{X}$ non-criterion = 2.1; *t* = 4.07; *df* = 58, $p < .001$). Similar *t* tests were also computed for individual groups and for instruction and reinforcement conditions collapsing across groups, and in addition to the overall difference, a significant difference between criterion and non-criterion subjects' response latencies was found for the red reinforcement condition--general instructions, and red reinforcement collapsed across instructions, and for the minimal and the general instruction conditions (see Table 4).

In order to investigate the general relationship between response latencies and the learning of the discrimination problem a series of correlational analyses were performed. These analyses involved looking at the relationship between number correct and latencies as in previous studies (Turnure, 1972; Turnure & Larsen 1971, 1972). Table 5 presents the Pearson product-moment correlations and their significance levels for all experimental groups. In addition to the correlations for the red reinforcement-general instructions condition, the overall picture reinforcement condition, the minimal and the general instructions conditions, the overall correlation, i.e., between latency and number correct collapsing across all experimental groups, was found significant ($r = .52$, *df* = 58, $p < .01$). In most cases, then, those groups and conditions for which the mean response latencies for criterion and non-

Table

Mean Pre-criterion Response Latencies for Criterion and

Non-criterion Subjects in All Experimental Groups

	No Reinforcement		Red		Picture		Total		Explicit	
	Crit.	Non-crit.	Crit.	Non-crit.	Crit.	Non-crit.	Crit.	Non-crit.	Crit.	Non-crit.
Minimal Instruction										
$\overline{X}$	3.8	2.3	3.3	1.8	3.0	2.0	3.2	2.1[c]	3.7	2.6
SD	0	.8	.8	.8	.9	.4	.8	.7	1.4	1.2
n	1	7	3	5	4	4	8	16	10	2
General Instruction										
$\overline{X}$	2.9	2.0	4.0	2.4[a]	2.6	1.8	3.1	2.1[d]		
SD	.6	.6	.8	.6	1.5	.6	1.1	.6		
n	6	2	4	4	4	4	14	10		
Total										
$\overline{X}$	3.0	2.3	3.7	2.0[b]	2.8	1.9				
SD	.7	.8	.3	.8	1.2	.5				
n	7	9	7	9	8	8				

[a] $\underline{t}$ between criterion and non-criterion $\underline{Ss}$ = 2.77, $\underline{df}$ = 6, $\underline{p} < .05$

[b] $\underline{t}$ between criterion and non-criterion $\underline{Ss}$ = 4.99, $\underline{df}$ = 14, $\underline{p} < .001$

[c] $\underline{t}$ between criterion and non-criterion $\underline{Ss}$ = 3.31, $\underline{df}$ = 22, $\underline{p} < .01$

[d] $\underline{t}$ between criterion and non-criterion $\underline{Ss}$ = 2.50, $\underline{df}$ = 22, $\underline{p} < .05$

Table 5

Pearson-Product Moment Correlations Between Pre-criterion Response Latencies and number Correct for All Subjects in All Experimental Groups*

	Reinforcement Condition				
	No reinforcement	Red	Picture	Total	Explicit
Minimal instruction					
r	.24	.65	.58	.48	.31
n	8	8	8	24	12
p	n.s.	n.s.	n.s.	.02	n.s.
General instruction					
r	.46	.72	.61	.56	
n	8	8	8	24	
p	n.s.	.05	n.s.	.01	
Total					Overall
r	.32	.66	.59		.52
n	16	16	16		60
p	n.s.	.01	.02		.001

* Pre-criterion response latency scores for non-criterion $\underline{S}$s = $\frac{\text{Total Response Latency}}{\text{Total trials}}$

criterion subjects were found to be significantly different, were also those groups and conditions for which significant correlations between latencies and learning were found: The exception was the finding of a significant correlation for the overall picture condition, but a significant t for overall red reinforcement.

Responses to question of same, not same

Of the 12 subjects who had been given instructions (either general or explicit) which told them to choose the picture that was "not the same as the others," and who did not reach criterion, eight could correctly identify which pictures were the same and which were not the same upon questioning after completing the learning task. Two of the four remaining subjects could not identify "same" or "not the same" correctly, either with the general questioning or when the experimenter specified with which picture they were to compare. The remaining two subjects could identify which pictures were the same on initial questioning, and could identify which pictures were not the same when the experimenter further specified the picture which they were to make the comparison.

For 44 subjects, then, (34 criterion, 10 non-criterion) it is clear that a "same-not same" discrimination could be made. For two other children tested it seems that discrimination was not developed. For the remaining 14 subjects, all of whom received only the minimal instructions and who subsequently were not questioned as to their knowledge of "same-not same," no firm conclusion can be drawn. However, it seems likely on the basis of the above results, that the majority of these subjects would probably also demonstrate the "same-not same" discrimination when asked.

Discussion

The data of the present study produced some significant results of general interest, primarily attributable to the effects of differing instructions. The findings suggest, as a number of investigators have done recently (Reitman, 1970; Taylor, 1971), that instructions are an influential, although a relatively unexplored variable in learning, and further that investigation of subject characteristics and the interactions between subject characteristics and the instructions given is a worthwhile direction pursue in learning as well as in other areas pertinent to intellectual development, e.g. perception (Gibson, 1969, pp. 334-338).

Few statistically significant findings provided support for the analysis of reinforcement effects presented earlier, nor for the hypothesis that particular potency would inhere in feedback which was presumed to be "intrinsically meaningful" to the task. However, differential performances were observed across the groups, and it could be enlightening to examine them in some detail. The effort expended in this instructional endeavor may not be commensurate with the evidence available, but at this early stage of a somewhat original undertaking close scrutiny of initial evidence does not seem amiss.

Consider that the percentage of criterion subjects ranged from 12.5% in the minimal instruction - no reinforcement condition to 83% in the explicit condition, which very nicely conforms to prediction. Of course, the intermediate conditions were not at all in accord with the "underlying dimensions" implicit in the hypothesis. Of most interest is the deviation of the general instruction-no reinforcement group which theoretically should have been only very little superior to its minimal instruction counterpart (at least according to a gross derivation from general "reinforcement theory"), but which in fact was superior to all groups save the explicit. The superior performance of this group is clearly attributable to the effects of the instructions on the generalized response biases (Hall, 1971) of the subjects which in turn demonstrates a) that these instructions, at least, were clear and effective, b) that response biases are readily modified, at least for normal children (as opposed, apparently, to retarded children, cf. Hall, 1971), c) that the children understood the meaning of "not the same," a conclusion verified by post-task interview, d) that the stimuli were discriminable, and e) that, given the foregoing conditions, feedback or reinforcement is not necessary to establish or maintain systematic responses to abstract stimulus dimensions, i.e., the oddity relation. This last observation leads to consideration of the general lack of improvement obtained from the reinforcement conditions utilized in this experiment.

Descriptively, we recall that the four reinforcement groups in question all fell approximately midway between the two no-reinforcement conditions in learning on both the number correct and percentage of criterion subjects learning indices. We may ask the correlative question then, "Why were the performances of subjects in these four conditions enhanced, compared to the minimal instruction-no reinforcement group?" The most parsimonious answer to the first part of this question is that the reinforcement-feedback presented in the red and picture reinforcement conditions provided sufficient guidance and/or incentive, to induce consistent responding to the designated stimulus characteristic, i.e. "not same," and this explanation is most appropriate for the minimal instruction conditions, where there does not appear to be any other explanation available. While the same response guidance/incentive factors exist in the general instruction conditions, these subjects also were provided with the information crucial to task solution, but did poorer than the no-reinforcement group. It sppears that the attempt to incorporate contingent stimulus feedback into a task structure that was quite satisfactorily communicated by the general instructions alone, and conveyed somewhat less satisfactorily by the feedback alone, foundered in the insufficiency of the information provided, or in the inadequate provision of more physical requirements, such as time for the children to assimulate the directions, or repetition of the crucial elements of the instruction. The importance of the latter provision is attested by the positive outcome of the explicit condition, which basically just did repeat the information more than was done in the general instructions.

One last technical point emerges from a close scrutiny of the varied conditions of the study. Subjects in all the "reinforcement" conditions, including the explicit, were required to make an additional orienting response, to the upper panels, after their instrumental response, to perceive the feedback information. This additional task requirement may have been an additional burden on some subjects, since voluntary control of orienting responses is an ability just being mastered by many children in the age range studied (Turnure, 1970, 1971).

A final general point also should be made pertaining to the failure of the "intrinsically meaningful" feedback to enhance performance over that of extrinsic feedback. The assumption behind this manipulation was that feedback which actually "operated" on the relation in question would facilitate performance in some way. In the procedures of this study the crucial aspects of this hypothetical interrelationship actually were never specified or pointed out to the subjects in any condition. Thus, at no time were "picture reinforcement" subjects told "to be correct you must eliminate the oddity relation in the stimulus complex by producing another of the single stimulus objects you will see in the initial array, so as to form a pair which will then be equivalent to the pair of objects contained in the original array," or the like, and given the ages of the subjects it should be easy to see why. This is to say, most simply, that the "intrinsic meaningfulness" hypothesis may not have been tested in the direct conceptual way that appears to be required, but, at best, was tested only as to whether some form of a "primitive" perception of the stimulus interrelationships would manifest itself on the task. Thus, for this and other reasons implied above, it may be necessary to test the hypothesis with much older children. Modification of the instructions to suit individual children may also prove workable, but this type of "clinical method" (see Ginsberg & Opper, 1969, for a discussion of Piaget's use of the "clinical method"), "can create problems of its own" as Gibson (1969, p. 338) points out. She goes on to comment, "Ingenuity in putting questions about what is perceived at different age levels is still an urgent need" (1969, p. 338); to which we may add as well "in putting instructions."

The learning data provided several other findings relating to somewhat different concerns. The very poor performance of subjects in the no reinforcement-minimal instruction condition indicates that the oddity response preference found in mentally retarded populations (cf. Dickerson & Gireadeau, 1970) was not a dominant response tendency in these nursery school subjects. It is interesting to note, however, that the one subject who achieved criterion in the no reinforcement-minimal instruction condition did choose the odd item consistently from the very first trial. The significant overall correlation of number correct scores with age seem also to be a predictable finding, in that numerous studies of oddity learning have found a general linear increase in learning with age. This relationship between age and performance, however, appeared to play a very little role within any one experimental group. Interestingly, it was only for the no reinforcement-minimal instruction group that a significant correlation, other than for across the entire sample, was found. This would suggest that in the absence of any feedback or guidance as to how to proceed on the task, the older subjects are employing more successful strategies; however, as soon as one or another of these factors is introduced age differences tend to be obscured or diminished (see also Hall, 1971). Of course, restricted age ranges and very small _ns_ act against finding relationships. It was clear also that age was not related to the ability to transfer the oddity concept, given it was demonstrated on the original task. This finding replicates previous reports that the oddity response, once firmly established, transfers immediately to any situation in which the oddity relationship is present (House, 1964; Levin & Maurer, 1969).

The response latency data parallel in many respects that found in previous studies using an oddity learning task (Turnure, 1972, in preparation; Turnure & Larsen, 1971, 1972). Criterion subjects were found to respond significantly slower than the non-criterion subjects, and slow response was highly correlated with greater learning. Clearly then, those subjects who learned were responding in a different fashion than those subjects who did not learn. Several qualitative observations on the part of the experimenter might be inserted at this point. Children who tended to approach the task in a more deliberate fashion appeared to be those who learned most often. That is, many children were observed to be very eager to begin, seeming to want to push windows as soon as they were seated before the apparatus, and even prior to being told anything about the game. Many of these same children responded almost immediately as the slides came on, and then when their responses were incorrect pushed other windows repeatedly, apparently in an effort to find the correct item. Instructions to these children to push only one window each time usually were unheeded. It might be hypothesized that the more impulsive children benefited neither from the instructions nor from the reinforcement feedback. In particular, the general instructions may have been inadequate for these children who were so eager to begin the task, whereas the more explicit instructions which repeated several times that the right choice was the one that was not the same as the others may have, perhaps because of the repetition alone, were more effective. These experimenter observations were unfortunately not systematically undertaken, and clear documentation of differences in subject characteristics relative to learning and the attention to instruction seems necessary. A large number of studies, however, have explored the question of differential cognitive strategies and cognitive styles in a variety of learning situations (cf. Kagan & Kogan, 1970), and it seems reasonable that this may be an important variable to explore in oddity learning, particularly when repeated findings of differential responding styles of criterion and non-criterion subjects are noted.

One other point might be mentioned in this connection. The large majority of nursery school children in the present study were able to discriminate "same" and "not same" upon questioning, even when they did not respond to instructions to do so on the oddity task. Corraborating this observation, House (1964) and Saravo and Gollin (1969) have reported that the ability to identify objects on the basis of same, not same or different, did not predict performance on oddity learning tasks. However, their subjects were not given instructions to attend to the "same-not same" dimension. In fact, in the present study, the condition that repeated these instructions several times did appear to be more effective than those which did not. This insistent repetition, or perhaps merely the increased latency between seeing the apparatus and performing on it (cf. Schwebel & Bernstein, 1970) cohering with the repetition, appears to have modified the explicit condition children's impulsivity regarding instrumental responding, and, possibly, augmented their observing response tendences, as well as enhancing their conception of the task. Any or all of these effects would have been beneficial, and effort should be expended toward the explication of the effects and interactions.

Further Observations

Replication study

In view of the rather inconclusive, although at some points suggestive results with the 60 children in the study above, a third group of nursery children were tested under the identical experimental procedures in an effort to replicate and clarify some of these earlier findings.

Subjects

Forty-seven children were selected from a third nursery school near St. Paul, Minnesota.[1] These children were characterized by the school's director as coming from middle class families and being at least of average ability, and so appeared to be slightly lower in SES and IQ than the previous school samples. Also, whereas the first two schools had been located within the city of St. Paul itself and were rather exclusive, the third school was in a suburban area, and the children from this latter school may or may not have been exposed to differential experiences which in turn might have affected their performance in the study.

Some effort was made to select children from the third school (S3) so as to be as similar in age to those included in the original sample as possible. However, the mean age of the third sample was greater, $\bar{X}$ = 62.4 months, than both of the other two school samples. When all three schools were compared in a 3 (schools) x 2 (instruction condition) x 3 (reinforcement condition) analysis of variance, the schools factor emerged significant (F = 31.5, df = 2, 104, $p < .001$). A subsequent Newman-Keuls analysis showed that not only was the mean age of S3 greater than that of S1 and of S2, but in contrast to the finding in the two-school comparison (S1 vs. S2) described earlier (p. 11), S1 was now found significantly older than S2. No statistically significant age differences appeared within the explicit condition alone, however ($\underline{F}$ = 2.34, $\underline{df}$ = 2, 17, n.s.).

Table 6 presents the number of subjects from S3, their mean ages and standard deviations in each experimental group.

Apparatus and procedures

As was indicated above, the apparatus used and procedures followed with the subjects from the third school were identical to those used in the original sample.

Results

School 3 learning scores for all experimental groups are shown in Table 7. Instruction condition (2) x Reinforcement condition (3) analysis of variance of the number correct produced a significant instruction condition effect (F = 4.55, $\underline{df}$ = 1, 33, $\underline{p}$ < ,05), a finding substantiating this treand obtained earlier with the two schools combined. Neither the meain effect of reinforcement type nor the interaction was significant. Within the explicit condition alone, a one-way analysis of variance among schools was significant ($\underline{F}$ = 3.98, $\underline{df}$ = 2, 17, $\underline{p}$ < .05). This difference is attributable primarily to the unexpectedly poor performance of the subjects from S3, who performed significantly worse than S2 subjects ($\underline{t}$ = 2.79, $\underline{df}$ = 14, $\underline{p}$ < .01), and poorer, but not significantly so, than S1 subjects ($\underline{t}$ = 1.23, $\underline{df}$ = 10, n.s.). Table 7 shows that the subjects in the explicit condition even performed more poorly on the average than

Table 6

Mean Chronological Age (in months) and

Standard Deviations for Schoc' Sample 3 (S3)

Reinforcement Condition

	No Reinforcement	Red	Picture	Explicit
Minimal Instruction				
$\overline{X}$	60.5	60.3	60.0	58.0
SD	2.6	2.5	3.4	5.1
n	4	3	4	5
General Instruction				
$\overline{X}$	59.8	59.8	60.0	
SD	3.8	2.5	2.9	
n	4	4	4	

Table 7

Mean Number Correct, Standard Deviations and Number of

Criterion Subjects for Each Experimental Group

Reinforcement Condition

	No reinforcement	Red	Picture	Total	Explicit
Minimal Instruction					
$\overline{X}$	17.8	11.7	20.8	17.0	16.6
SD	8.3	3.8	9.9	8.4	9.7
n	6	6	7	19	8
#Crit.Ss	1	0	3	4	3
General Instruction					
$\overline{X}$	24.8	22.7	23.7	23.7	
SD	9.3	10.6	13.2	10.7	
n	6	7	7	20	
#Crit.Ss	4	4	4	12	
Total					
$\overline{X}$	21.3	17.6	22.3		
SD	9.2	9.8	11.3		
n	12	13	14		
#Crit.Ss	5	4	7		

subjects in the no-reinforcement-minimal instructions condition, and showed no superiority to any general groups whether collapsed over reinforcement or instructions, thus failing to replicate the findings of the main study for the explicit condition.

Following the procedures of analysis used with the two-school sample, a number of correlational analyses of number correct with CA were undertaken (see Table 9). Whereas in the two-school study proper a significant correlation of number of correct scores with age was found for the total subject sample, schools and experimental conditions collapsed, in the third school this significant overall correlation was not obtained ($\underline{r} = -.03$, $\underline{df} = 45$). In fact, only in the picture reinforcement-minimal instruction condition was a significant age-learning score correlation found for the third school, and it was negative (the two youngest Ss got by far the two highest scores). It should be mentioned, however, that very few significant correlations had been found even when the two schools studied earlier were combined (pp. 28-29). Looking more closely at the explicit condition, a high, positive ($\underline{r} = .68$, $\underline{df} = 6$) but nonsignificant correlation between age and number correct scores was found for S3. The only other positive correlation found in this sample was in the picture reinforcement-general instruction condition, the condition most similar to the explicit. In all cases the sample sizes are so very small as to require that any interpretation of the correlations be made with caution. However, CA does not seem to be a clear factor in the differential learning performances which were found, at least in the four to five year old age range of this sample.

Differences in response latency performance and the relationship between response latency and learning scores were again explored. An Instruction condition x Reinforcement condition analysis of variance of the group's overall mean latencies averaged over the 36 trials was initially performed. Again, as in the two-school analyses, no significant differences emerge in the one-way analyses comparing explicit and instruction conditions, and explicit and reinforcement conditions. A _t_ test for correlated means between pre- and post-criterion latencies of those criterion subjects for whom both pre- and post-criterion response latencies were available, was significant (t = 2.42, df = 18, p < .05). Therefore, subsequent latency analyses and correlational analyses of latencies and learning were performed on mean pre-criterion latencies.

With all groups combined, the mean response latency for 19 criterion subjects was significantly longer ($\bar{X}$ = 3.4, SD = 1.3) than for the 28 non-criterion subjects ($\bar{X}$ = 1.9 , SD = .6; t = 5.21, df = 45, p < .001). Similar _t_ tests were also computed for individual groups, and the red reinforcement-general instruction group and both instruction and the red and picture reinforcement conditions all showed significant differences between criterion and non-criterion subject latencies (see Table 8). These findings replicated similar ones in the study proper, and added that for the picture reinforcement condition.

The general relationship between response latencies and the learning of the discrimination problem was investigated by means of correlational analyses for the S3 sample. Table 9 presents the Pearson product-moment correlations and their significance levels for all experimental groups. A significant correlation was found within the

Table 8

Mean Pre-criterion Response Latencies for Criterion and Non-criterion Subjects in All Experimental Groups

	No Reinforcement		Red		Picture		Total		Explicit	
	Crit.	Non-crit.	Crit.	Non-crit.	Crit.	Non-crit.	Crit.	Non-crit.	Crit.	Non-crit.
Minimal Instruction										
$\bar{X}$	3.0	2.2		1.9	3.7	1.7	3.6	1.9[d]	2.7	2.2
SD	0	.8		.8	1.9	.6	1.6	.7	.4	.6
n	1	5	0	6	3	4	4	15	3	5
General Instruction										
$\bar{X}$	3.7	2.0	3.2	1.8[a]	3.9	1.5	3.6	1.7[e]		
SD	2.0	.2	.2	.4	1.5	.2	1.3	.3		
n	4	2	4	3	4	3	12	8		
Total										
$\bar{X}$	3.6	2.1	3.2	1.8[b]	3.8	1.6[c]				
SD	1.7	.6	.2	.6	1.5	.4				
n	5	7	4	9	7	7				

[a] $\underline{t}$ between criterion and non-criterion $\underline{S}s$ = 5.13, $\underline{df}$ = 5, $\underline{p} < .01$

[b] $\underline{t}$ between criterion and non-criterion $\underline{S}s$ = 4.19, $\underline{df}$ = 11, $\underline{p} < .01$

[c] $\underline{t}$ between criterion and non-criterion $\underline{S}s$ = 3.47, $\underline{df}$ = 12, $\underline{p} < .01$

[d] $\underline{t}$ between criterion and non-criterion $\underline{S}s$ = [illegible], $\underline{df}$ = 17, $\underline{p} < .01$

[e] $\underline{t}$ between criterion and non-criterion $\underline{S}s$ = 3.85, $\underline{df}$ = 18, $\underline{p} < .01$

Table 9

Pearson Product-Moment Correlations Between Mean Precriterion Response Latencies and Number Correct for All Experimental Groups in School 3

	No reinforcement	Red	Picture	Total	Explicit
Minimal Instruction					
r	.78	-.42	.90	.72	.44
n	6	6	7	19	8
p	n.s.	n.s.	.01	.001	n.s.
General Instruction					
r	.77	.91	.79	.77	
n	6	7	7	20	
p	n.s.	.01	.05	.001	
Total					Overall
r	.76	.65	.83		.72
n	12	13	14		47
p	.01	.01	.001		.001

total sample ($r = .69$, $df = 45$, $p < .001$). Consistent with the above finding of more significant differences between criterion and non-criterion subjects in the third school, there are also several more significant learning-latency correlations (compare Table 5, p. 33 and Table 9). In all experimental groups and conditions in which a significant learning-latency correlation was found in the study proper, a significant correlation was found in the sample, with the addition of significant findings in the two picture reinforcement conditions.

Responses to questions of not same

Of the 13 subjects who did not reach criterion in S3 and who had been given instructions (either general or explicit) which told them to choose the picture that was "not the same as the others," eight could correctly identify which pictures were the same and which were not the same upon questioning after completing the learning task. Three of the five who could not were in the explicit condition (also one subject each in the picture and no reinforcement conditions) and one of these three subjects could not correctly identify which pictures were not the same even when the experimenter further specified the picture with which they were to make the comparison (one subject in the no reinforcement condition also could not make this identification correctly).

Although absolute numbers are so small in some conditions as to make statistical analyses questionable, it does not appear that the overall percentage of subjects who showed comprehension of the concept of "not the same" is significantly less for S3 in comparison to S1 or S2 (see Table 10). There is some indication however, that the percentage of subjects showing comprehension is smaller for the explicit condition S3 subjects; the only explicit condition subjects who

Table 10

Percentage of Non-criterion Subjects Showing Comprehension

of the Concept "Not the Same"

Condition	S_1	S_2	S_3
No reinforcement	100%	100%	50%
n	1/1	1/1	1/2
Red reinforcement	100%	100%	100%
n	1/1	3/3	3/3
Picture reinforcement	0%	0%	33%
n	0/1	0/3	1/3
Explicit reinforcement	100%	100%	40%
n	1/1	1/1	2/5
Totals	75%	63%	54%
n	3/4	5/8	7/13

apparently could not identify which pictures were not the same were S3 subjects ($\underline{z} = 2.00$, $\underline{p} < .05$, for S_1 or S_2 tested against S_3).

Discussion

Contrary to expectations, with the addition of the third school sample, the results became less clear in certain important aspects. In particular, the very poor explicit group performance by school 3 makes it <u>less</u> evident that increasing the specificity of instructions improves performance. It is difficult in fact to understand why this group does so poorly in contrast to the other two schools, both of which were significantly younger, but both of which performed better than the S3 sample and no differently from each other. Age did not appear to be an obvious contributing factor to performance differences. The only data which suggest a possible variable influencing performance are that obtained from the questioning of subjects as to their knowledge of the concept "not the same." Fewer of the S3 subjects in the explicit condition understood this concept and this unfortunate fact of sampling may account for the discrepancy. In the six groups of the main design, the two conditions previously found the weakest, the minimal no- and red-reinforcement groups, reversed their relative standing, but otherwise the rank order of the groups is identical to the initial study. The previous discussion of possible reasons for the relative orderings of the groups is not thereby validated, but the obtained consistencies make the effort expended seem more worthwhile. A significant effect of instructions was found in this study; thus that aspect of the investigation appears to be on firm ground.

The response latency data provided replications of all of the major findings of the previous investigation, and extended the general implications of this measure by increasing the range of conditions in which effects were obtained. There appears to be no question but that response latency is a sensitive index of some subject characteristics, particularly when differences in the pre- and post-criterion segments of responding are considered. The problem with response latency as a measure is being certain what you are measuring. While there is good evidence (Turnure, 1972) that latency of response correlates with attention, as indexed by overt orienting responses (Turnure, 1970a, 1970b, 1971), studies also show that response latency accounts for significant amounts of variance in learning independent of attention (Turnure, 1972; Turnure & Larsen, 1971, 1972). It may be that response latency is a reflection of subjects' cognitive styles (Kagan & Kogan, 1970; Kagan, Rosman, Day, Albert, & Phillips, 1964; Kagan, 1966), as well as their "behavioral tempos" as we described earlier. But the "cognitive style" dimension requires a great deal more experimental work to validate it (cf. Pick & Pick, 1970) and to demonstrate its pragmatic value. Perhaps the present line of research, which has produced such consistent findings with the response latency measure, and which appears to have obvious correspondences with cognitive style, may contribute in alternative research strategy "which might provide stronger support for it [cognitive style]" (Pick & Pick, 1970, p. 807).

References

Bower, G. H. Mental imagery and associate learning. In L. Gregg (Ed.), Cognition in learning and memory. New York: Wiley, 1970.

Butterfield, E. C. Stimulus trace in the mentally retarded: Defect or developmental lag? Journal of Abnormal Psychology, 1968, 73, 358-362.

Croll, W. L. Response strategies in the oddity discrimination of pre-school children. Journal of Experimental Child Psychology, 1970, 9, 187-192.

Dickerson, D. J. & Girardeau, F. L. Oddity preference by mental retardates. Journal of Experimental Child Psychology, 1970, 10, 28-32.

Dowart, W., Ezerman, R., Lewis, M., & Rosenhan, D. The effect of brief social deprivation on social and nonsocial reinforcement. Journal of Personality and Social Psychology, 1965, 2, 111-115.

Ellis, N. R., Hawkins, W. F., Pryer, M. W., & Jones, R. W. Distraction effects in oddity learning by normal and mentally defective humans. American Journal of Mental Deficiency, 1963, 67, 576-83.

Gibson, E. J. Principles of perceptual learning and development. New York: Appleton-Century-Crofts, 1969.

Ginsburg, H., & Opper, S. Piaget's theory of intellectual development. Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1969.

Gollin, E., & Shirk, E. J. A developmental study of oddity-problem learning in young children. Child Development, 1966, 37, 213-217.

Gollin, E. S., Saravo, A. & Salten, C. Perceptual distinctiveness and oddity-problem solving in children. Journal of Experimental Child Psychology, 1967, 5, 586-596.

Grant, D. A. Additional tables of the probability of "runs" of correct responses in learning and problem solvi ,. Psychological Bulletin, 1947, 44, 276-279.

Hall, J. E. Effect of response bias of mental retardates upon oddity learning. American Journal of Mental Deficiency, 1971, 75, 579-585.

Hill, S. D. Performance of young children on three discrimination learning tasks. Child Development, 1965, 36, 425-435.

House, B. Oddity performance in retardates: I. Acquisition and transfer. Child Development, 1964, 35, 635-643.

Kagan, J. Developmental studies in reflection and analysis. In A. H. Kidd and J. H. Rivoire (Eds.), Perceptual development in children. New York: International Universities Press, 1966.

Kagan, J. & Kogan, N. Individual variation in cognitive processes In P. H. Mussen (Ed.), Carmichael's manual of child psychology. Vol. 1. New York: John Wiley & Sons, 1970.

Kagan, J., Rosman, B., Day, D., Albert, J., & Phillips, W. Information processing in the child: Significance of analytic and reflective attitudes. Psychological Monographs, 1964, 78 (Whole No. 578).

Levin, G. R., & Maurer, D. M. The solution process in children's matching-to-sample. Developmental Psychology, 1969, 1, 679-690.

Lewis, M., Wall, A. M., Aronfreed, J. Developmental change in the relative values of social and non-social reinforcement. Journal of Experimental Psychology, 1963, 66, 133-137.

Lipsitt, L. P. & Serunian, S. A. Oddity-problem in young children. Child Development, 1963, 34, 201-206.

Lubker, B. J., & Spiker, C. C. The effects of irrelevant stimulus dimensions on children's oddity-problem learning. Journal of Experimental Child Psychology, 1966, 3, 207-215.

Moon, L. E. & Harlow, H. F. Analyses of oddity learning by Rhesus monkeys. Journal of Comparative and Physiological Psychology, 1955, 48, 188-194.

Pick, H. L., & Pick, A. D. Sensory and perceptual development. In P. H. Mussen (Ed.), Carmichael's manual of child psychology. Vol. 1. New York: John Wiley & Sons, 1970.

Reitman, W. What does it take to remember? In N. A. Norman (Ed.), Models of memory. New York: Academic Press, 1970.

Saravo, A., Bagby, B., & Haskins, K. Transfer effects in children's oddity learning. Developmental Psychology, 1970, 2, 273-282.

Saravo, A., & Gollin, E. S. Oddity learning and learning sets in children. Journal of Experimental Child Psychology, 1969, 7, 541-552.

Schwebel, A. I., & Bernstein, A. J. The effects of impulsivity on the performance of lower-class children on four WISC subtests. American Journal of Orthopsychiatry, 1970, 40, 629-636.

Staats, A. W., Brewer, B. A., & Gross, M. C. Learning and cognitive development: Representative samples, cumulative-hierarchical learning and experimental-longitudinal methods. Monographs of the Society for Research in Child Development. 1970, 35, (8 Whole No. 141).

Taylor, A. M. Memory strategies for the slow learner. Interact, Newsletter for Research and Development Center for Handicapped Children, University of Minnesota, Minneapolis. Spring-Summer, 1971.

Taylor, A. M., & Whitely, S. Imagery and verbal elaboration, organizational factors, and children's recall. Paper presented at the convention of the Society for Research in Child Development, April, 1971, Minneapolis.

Terrell, G., & Kennedy, W. A. Discrimination learning and transposition in children as a function of the nature of the reward. Journal of Experimental Psychology, 1957, 53, 257-260.

Turnure, J. E. Reactions to physical and social distractors by moderately retarded institutionalized children. Journal of Special Education, 1970, 4, 283-294. (a).

Turnure, J. E. Distractibility in the mentally retarded: Negative evidence for an orienting inadequacy. Exceptional Children, 1970, 37, 181-186. (b).

Turnure, J. E. Children's reactions to distractors in a learning situation. Developmental Psychology, 1970, 2, 115-122. (c)

Turnure, J. E. Control of orienting behavior in children under five years of age. Developmental Psychology, 1971, 4, 16-24.

Turnure, J. E. Interrelations of orienting responses, response latency and learning. In preparation, 1972.

Turnure, J., & Larsen, S. Outerdirectedness in educable mentally retarded boys and girls. Research Report No. 21, Research, Development, and Demonstration Center in Education of Handicapped Children, University of Minnesota, Minneapolis, 1971.

Turnure, J., & Larsen, S. Outerdirectedness in mentally retarded children as a function of sex of experimenter and sex of subject. Research Report No. 31, Research, Development, and Demonstration Center in Education of Handicapped Children, University of Minnesota, Minneapolis, 1972.

Turnure, J., & Zigler, E. Outer-directedness in the problem-solving of normal and retarded children. Journal of Abnormal and Social Psychology, 1964, 69, 427-436.

Witryol, S. L., Lowden, L. M., & Fagan, J. F. Incentive effects upon attention in children's discrimination learning. Journal of Experimental Child Psychology, 1967, 5, 94-108.

Zigler, E., & Kanzer, P. The effectiveness of two classes of verbal reinforcers on the performance of middle- and lower-class children. Journal of Personality, 1962, 30, 157-163.

Footnote

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Appendix: Report No. 32

Pilot Data

Subjects and Procedure

Thirty-seven pilot subjects between the ages of 3-2 and 5-1 were obtained from the University of Minnesota Nursery School. Of the original subjects, seven were "disadvantaged"* children and nine were younger children, 3-5 to 3-8. However, it was decided that since these 16 children would be very much younger (cf. Turnure, 1971) or from a different socio-economic background than the subjects selected for the study proper, and would therefore introduce additional, undesirable, variance to be contended with, they would be dropped from any formal analyses of the pilot data. Consequently, the number and mean ages of the "formal pilot subjects" tested in each experimental group, shown in Table 11, were not balanced across groups. The overall mean age of these pilot subjects was 50.6 months, and was significantly younger than the youngest group, S2, included in the study proper ($\underline{t}$ = 3.22, $\underline{df}$ = 57, $\underline{p} < .01$).

The procedures were basically similar to those described in the main text. A major exception occurred in running the disadvantaged and young subjects where the experimenter felt required to admonish these subjects to "look at all the pictures," "take your time," and so forth, in reaction to the subjects rather blatant "impulsivity."

Table 11

Mean Chronological Age (in months) and Standard Deviations for each Experimental Group of Formal Pilot Subjects

	No Reinforcement	Red	Picture	Explicit
Minimal instruction				
$\bar{X}$	55.0	51.0	51.5	47.5
SD	7.1	7.1	6.4	3.8
n	2	4	4	4
General instruction				
$\bar{X}$	48.3	53.5	51.5	
SD	1.5	.7	3.5	
n	3	2	2	

Results and Discussion

Table 12 includes the mean CA, number correct and response latency data for each of the three populations of pilot subjects. On a purely descriptive basis, it is obvious from Table 12 that the disadvantaged subjects, although of the same CA as the formal sample and over six months older than the younger sample, were showing inferior performance to both contrast groups, in number correct and response latencies. Indeed, it was the obvious relationship of these subjects rapid responding and poor learning, which persisted despite some informal efforts by the experimenter to moderate this type of responding, that sensitized the writers to the involvement of the type of "impulsiveness" discussed in earlier sections of the Report. Of course, the younger subjects' performance levels were nearer to those of the disadvantaged than to the older formal sample, which appears to be a typical pattern of results in comparative-developmental research at present (see, for instance, Eska & Block, 1971). The general developmental increase for younger and older subjects confirms Strong's (1966) findings for such young children, and the fact that no child under 3-9 solved the problem replicates his findings for that age with six subjects tested on the Primate Automatic Testing Apparatus-Key, although he found two of six other subjects this age reaching criterion on a standard WGTA using stereometric stimuli (see also, Etaugh & Van Sickle, 1971). The 29% of criterion subjects for the older subjects is near Strong's finding of 33% four and five year old PATA-K apparatus subjects reaching criterion, and midway between the findings of Lipsitt and Serunian (1963, 17%) and Gollin and Shirk

Table 12

Mean Chronological Ages, Number Correct and Response Latency Data for

Three Populations of Pilot Subjects

	Young	Disadvantaged	Formal Sample	Overall
Age				
$\overline{X}$	42.8	49.3	50.7	48.5
SD	1.0	3.9	5.0	5.3
n	9	7	21	37
Number Correct				
$\overline{X}$	12.2	9.3	18.1	15.0
SD	1.6	1.9	8.5	7.4
Overall Response Latency				
$\overline{X}$	1.7	1.4	2.2	1.9
SD	.4	.6	.7	.7
			Crit. Ss n=6	
			Precrit. lat	
			$\overline{X}$ 3.4	
			SD 1.4	
			Postcrit. lat	
			$\overline{X}$ 2.3	
			SD .7	

(1966: 42%).

The data for the 21 subjects of the formal pilot study is presented distributed across conditions in Table 13. As regards the major hypotheses of the "study proper," as they were being developed, the relatively strong performance of the general instructions - picture reinforcement and the explicit condition groups was interpreted as being in accord with them and so, supportive of carrying out a full-fledged investigation. But while these two groups' data showed good concordance with the hypotheses and with the bulk of the data subsequently to be gathered (see main text), it is clear from hindsight that the learning data from most of the other pilot groups just add to the confusion found in the later data. Most noteworthy in this respect are the poor performances of the few subjects in the general instruction-red and minimal instruction-picture groups, which had help up rather strongly in the data reported in the main text. Perhaps, in the interests of parsimony and peace of mind, we may chalk these results up to the vagaries of sampling.

The two other aspects of the data from these subjects which pertained to the subsequent research were response latencies and understanding of the "same-not same" distinction. In Table 12 we may see that criterion subjects tended to respond with longer latencies prior to criterion, just as we would expect, and that the mean time of pre-criterion responding appears higher than that determinable for any contrast group, young, disadvantaged, or older non-criterion. The proportion of relevant non-criterion subjects who seemed to understand the concept of "not the same" appears to be slightly less than that found for the other samples (see Table 14).

Table 13

Mean Number Correct and Standard Deviations for each

Experimental Group of Formal Pilot Subjects

	No Reinforcement	Red	Picture	Explicit
Minimal Instruction				
$\overline{X}$	17.0	17.8	13.3	23.8
SD	1.4	8.9	2.8	8.5
n	2	4	4	4
#Crit.Ss	0	1	0	2
General Instruction				
$\overline{X}$	18.3	11.5	25.0	
SD	14.0	3.5	12.7	
n	3	2	2	
#Crit.Ss	1	0	1	

Table 14

Percentage of Non-criterion Subjects Showing Comprehension of the Concept "Not the Same" in Formal Pilot Sample

Condition	n	%
No reinforcement	1/2	50%
Red reinforcement	1/2	50%
Picture reinforcement	0/1	0%
Explicit reinforcement	1/2	50%
Totals	3/7	43%

Additional References Cited in Appendix

Eska, B., & Black, K. N. Conceptual tempo in young grade-school children. Child Development, 1971, 42, 505-516.

Etaugh, C. F., & Sickle, D. V. Discrimination of stereometric objects and photographs of objects by children. Child Development, 1971, 42, 1580-1582.

Strong, P. N. Comparative studies in simple oddity learning: II. Children, adults and seniles. Psychonomic Science, 1966, 6, 459-460.

22. R. Bruininks & J. Rynders. Alternatives to Special Class Placement for Educable Mentally Retarded Children. Occasional Paper #6. March, 1971. (Focus on Exceptional Children, 1971, 3, 1-12)

23. J. Turnure, S. Larsen, & M. Thurlow. Two Studies on Verbal Elaboration in Special Populations I. The Effects of Brain Injury II. Evidence of Transfer of Training. Research Report #17. April, 1971.

24. D. Moores. Recent Research on Manual Communication. Occasional Paper #7. April, 1971. (Keynote Address, Division of Communication Disorders, Council for Exceptional Children Annual Convention, Miami Beach, April, 1971).

25. D. Moores. An Investigation of the Psycholinguistic Functioning of Deaf Adolescents. Research Report #18. May, 1971. (Exceptional Children, May, 1970, 36, 645-652).

26. G. Siegel. Three Approaches to Speech Retardation. Occasional Paper #8. May, 1971.

27. M. Thurlow & J. Turnure. Mental Elaboration and the Extension of Mediational Research: List Length of Verbal Phenomena in the Mentally Retarded[1]. Research Report #19. June, 1971.

28. R. Bruininks, T. Glaman, & C. Clark. Prevalence of Learning Disabilities: Findings, Issues, and Recommendations. Research Report #20. June, 1971. (Presented at Council for Exceptional Children Convention, Miami Beach, April, 1971).

29. J. Turnure & S. Larsen. Outerdirectedness in Educable Mentally Retarded Boys and Girls. Research Report #21. September, 1971.

30. A. Taylor, M. Josberger, & J. Knowlton. Mental Elaboration and Learning in Retarded Children[1]. Research Report #22. September, 1971. (Mental Elaboration and Learning in EMR Children[1], American Journal of Mental Deficiency, 1972 in press.)

31. W. Bart & P. Krus. An Ordering-Theoretic Method to Determine Hierarchies Among Items. Research Report #23. September, 1971.

32. A. Taylor, M. Josberger, & S. Whitely. Elaboration Training and Verbalization as Factors Facilitating Retarded Children's Recall. Research Report #24, October, 1971.

33. J. Turnure & M. Thurlow. Verbal Elaboration and the Promotion of Transfer of Training in Educable Mentally Retarded. Research Report #25. November, 1971.

34. S. Samuels. Attention and Visual Memory in Reading Acquisition*. Research Report #26, November, 1971.

35. S. Samuels. Success and Failure in Learning to Read: A Critique of the Research. Occasional Paper #9. November, 1971. (In M. Kling, the Literature of Research in Reading with Emphasis on Models, Rutgers University, 1971).

36. D. Moores & C. McIntyre. Evaluation of Programs for Hearing Impaired Children: Progress Report 1970-71. Research Report #27, December, 1971

37. J. Turnure & M. Thurlow. Verbal Elaboration Phenomena in Nursery School Children[1]. Research Report #28. December, 1971.

38. F. Danner & A. Taylor. Pictures and Relational Imagery Training in Children's Learning.[1] Research Report #29. December, 1971.

39. J. Rynders & J. M. Horrobin. A Mobile Unit for Delivering Educational Services to Down's Syndrome (Mongoloid) Infants. Research Report #30. January, 1972. (Presented at Council for Exceptional Children, Special National Conference, Memphis, December, 1971).

40. J. Turnure & S. Larsen. Outerdirectedness in Mentally Retarded Children as a Function of Sex of Experimenter and Sex of Subject[1]. Research Report #31. March, 1972.

41. J. Turnure & S. Larsen. Effects of Various Instruction and Reinforcement Conditions on the Learning of a Three-Position Oddity Problem by Nursery School Children. Research Report #32. March, 1972.

42. D. Krus and W. Bart. An Ordering-Theoretic Method of Multidimensional Scaling of Items. Research Report #33. March 1972.

43. J. Turnure & M. Thurlow. Verbal Elaboration in Children: Variations in Procedures and Design[1]. Research Report #34. March 1972.